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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/756,846	01/10/2001	Katsunobu Hori	50090-270	6055

7590

07/28/2003

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EXAMINER

VU, HUNG K

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 07/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/756,846

Applicant(s)

HORI ET AL.

Examiner

Hung K. Vu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) 6-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn. In view of a further search, however, a new rejection is set forth further below. This action is not made final.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tao et al. (PN 6,399,515, of record) in view of Sudo (PN 5,420,462).

Tao et al. discloses, as shown in Figure 8, a semiconductor device comprising :

a first film wiring (36a) having a first film thickness;

a second film wiring (36b) having a second film thickness, the first film wiring and the thin film wiring being formed in a single layer;

a hard mask (38a) covering the surface of the first film;

wherein the hard mask is resistant to etching adapted for patterning of the thick film wiring and also to etching adapted for patterning of the second film wiring. Note that since Tao et al. discloses the hard mask having the same material as claimed, it is inherent that the hard mask also being resistant to heat.

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Tao et al. does not disclose the second film thickness that is smaller than the first film thickness. However, Sudo discloses a first film wiring (15a) having a first film thickness, a second film wiring (15b) having a second film thickness that is smaller than the first film thickness. Note Figures 2 and 3E of Sudo. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the second film wiring of Tao et al. having the second film thickness that is smaller than the first film thickness, such as taught by Sudo in order to prevent a semiconductor substrate from being subject to overetching when a gate electrode is formed, so that the changes of characteristics of the transistors are prevented whose gate insulative films have been becoming thinner as their elements have been finer.

With regard to claim 2, Tao et al. and Sudo disclose the hard mask comprises a silicon oxide film [Col. 9, lines 45-50 of Tao et al.].

With regard to claim 3, Tao et al. and Sudo disclose the hard mask comprises silicon nitride film [Col. 9, lines 45-50 of Tao et al.].

With regard to claim 17, although Tao et al. and Sudo do not disclose the hard mask is resistant to heat at 400°C, however, since Tao et al. and Sudo disclose the hard mask having the same material as claimed, it is inherent that the hard mask of Tao et al. and Sudo also being able to resistant to heat at 400°C.

3. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tao et al. (PN 6,399,515, of record) in view of Sudo (PN 5,420,462) and further in view of Williams (PN 6,087,269, of record).

Tao et al. and Sudo discloses the invention substantially as claimed including the semiconductor as recited in the rejection above. Tao et al. and Sudo further disclose the hard mask comprise conductor materials or dielectric materials [Col. 9, lines 40-44 of Tao et al.]. Tao et al. and Sudo do not disclose the conductor hard mask comprises tungsten. However, Williams discloses forming the conductor hard mask (16) comprising tungsten [Figure 6, Col. 3, line 49].

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the conductor hard mask of Tao et al. and Sudo comprise tungsten, such as taught by Williams in order to provided the advantage of increased resolution because of the thinner resist as well as the possibility of increased interconnect thickness which provides for greater current handling capability.

4. Claims 1-3, 5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akira (JP4-372133, of record) in view of Tao et al. (PN 6,399,515, of record).

Akira discloses, as shown in Figures 1(a) - 1(d), a semiconductor device comprising,

a thick film wiring (7) having a first film thickness;

a thin film wiring (6) having a second film thickness that is smaller than the first film thickness;

a mask (4) covering the surface of the thick film.

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Akira does not disclose the mask is the hard mask. However, Tao et al. discloses a mask (38a,38b) is used as a hard mask for etching. Note Figure 8 of Tao et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the mask of Akira with a hard mask, such as taught by Tao et al. in order to form the wiring layer with enhanced sidewall profile uniformity.

Note that since Tao et al. discloses the hard mask having the same material as claimed, it is inherent that the hard mask is resistant to etching adapted for patterning of the thick film wiring and also to etching adapted for patterning of the thin film wiring, and being resistant to heat.

With regard to claim 2, Akira and Tao et al. disclose the hard mask comprises a silicon oxide film [Col. 9, lines 45-50 of Tao et al.].

With regard to claim 3, Akira and Tao et al. disclose the hard mask comprises silicon nitride film [Col. 9, lines 45-50 of Tao et al.].

With regard to claim 5, Akira and Tao et al. disclose the thick film wiring serves as a wiring for an electric supply of the semiconductor device or as a wiring for ground.

With regard to claim 17, Akira and Tao et al. do not disclose the hard mask is resistant to heat at 400°C, however, since Akira and Tao et al. disclose the hard mask having the same material as claimed, it is inherent that the hard mask of Akira and Tao et al. also being able to resistant to heat at 400°C.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akira (JP4-372133, of record) in view of Tao et al. (PN 6,399,515, of record) and further in view of Williams (PN 6,087,269, of record).

Akira and Tao et al. discloses the invention substantially as claimed including the semiconductor as recited in the rejection above. Akira and Tao et al. further disclose the hard mask comprise conductor materials or dielectric materials [Col. 9, lines 40-44 of Tao et al.]. Akira and Tao et al. do not disclose the conductor hard mask comprises tungsten. However, Williams discloses forming the conductor hard mask (16) comprising tungsten [Figure 6, Col. 3, line 49].

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the conductor hard mask of Akira and Tao et al. comprise tungsten, such as taught by Williams in order to provided the advantage of increased resolution because of the thinner resist as well as the possibility of increased interconnect thickness which provides for greater current handling capability.

Response to Arguments

5. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung K. Vu whose telephone number is (703) 308-4079. The

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examiner can normally be reached on Mon-Thurs 6:00-3:30, alternate Friday 7:00-3:30, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Vu

July 16, 2003

Hung Vu